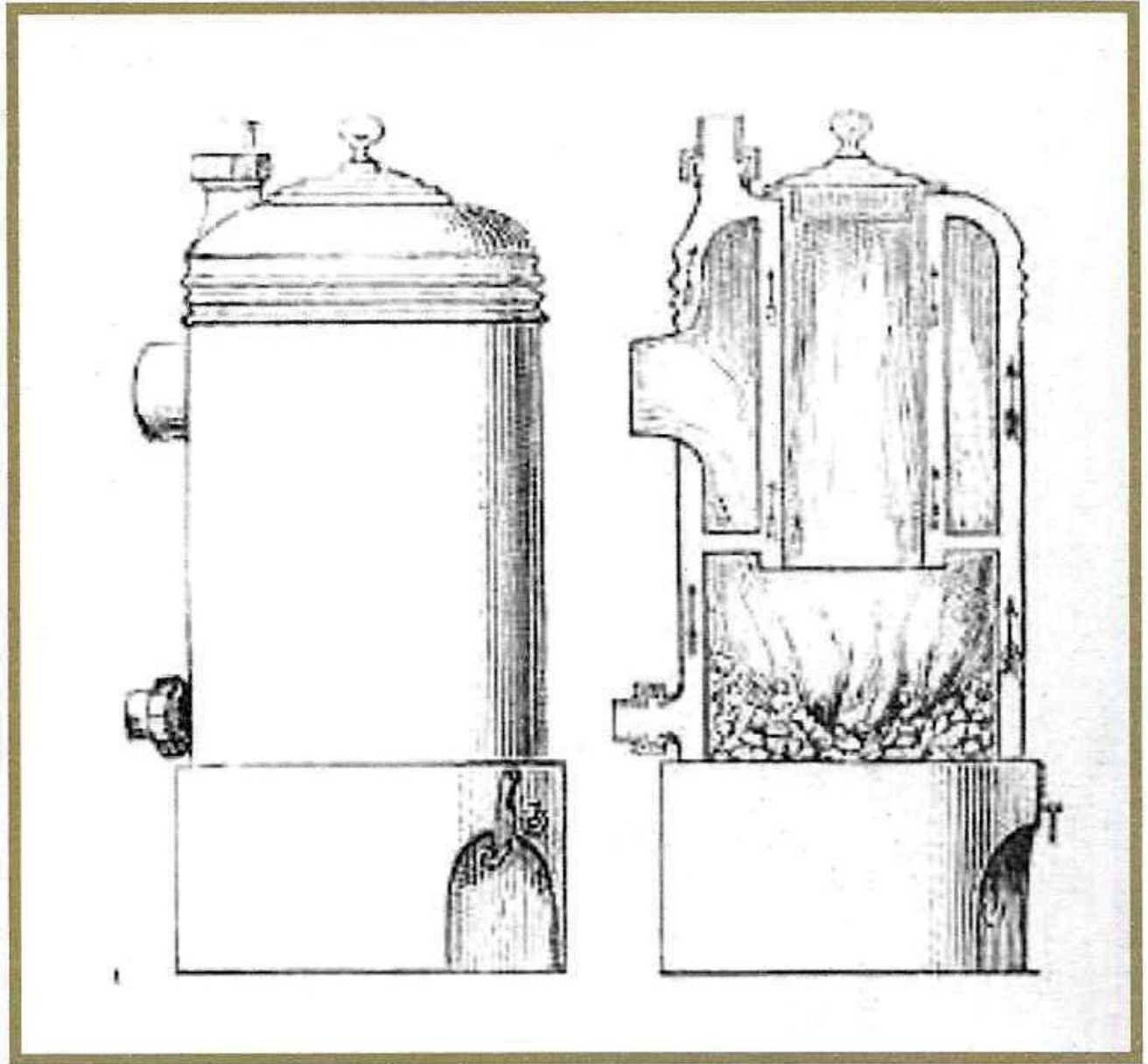


# STEAM & HOT WATER BOILERS 1840-1930

## *Hothouse Heating*

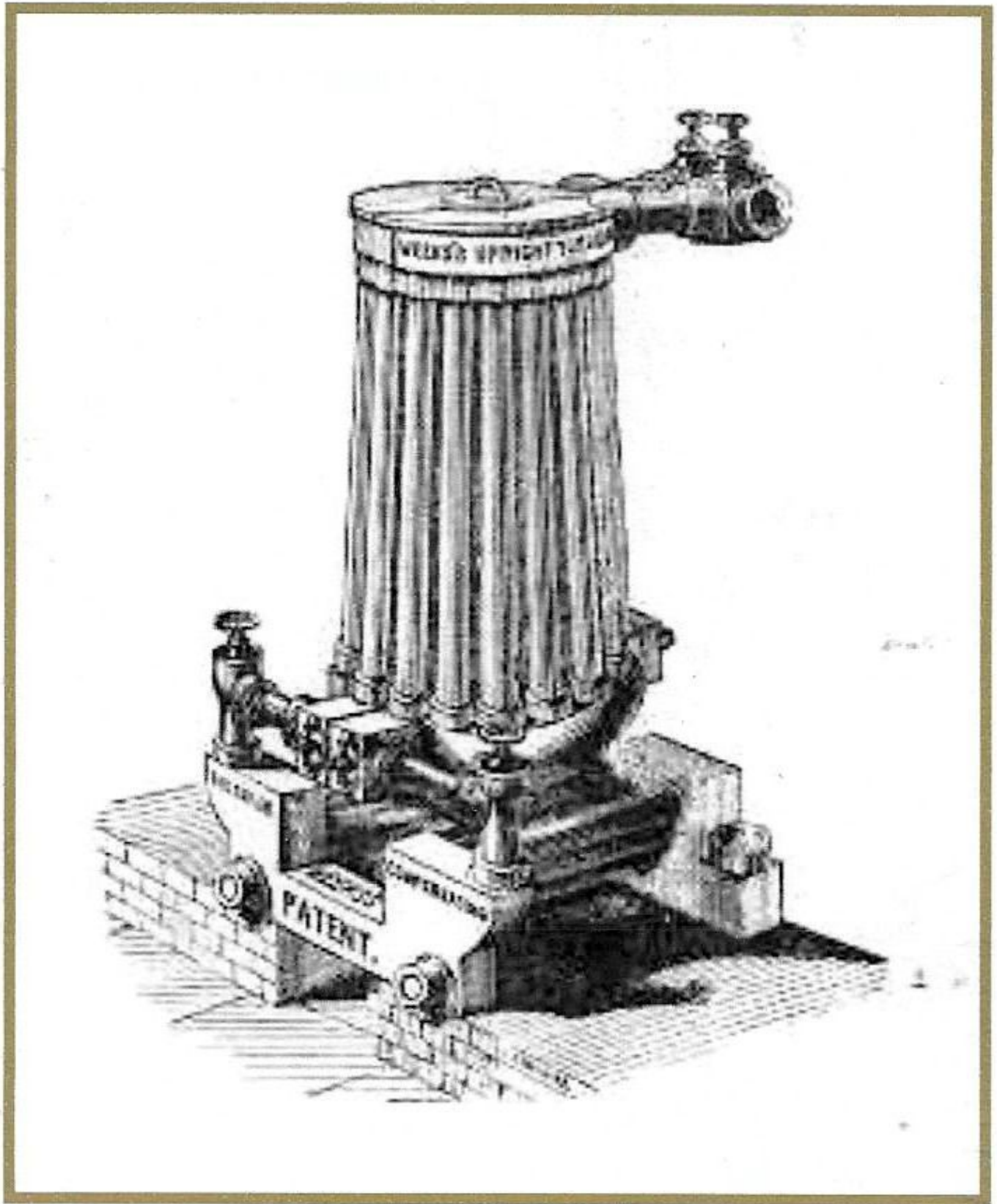


ILLUSTRATIONS FROM THE BOOKS SHOWN

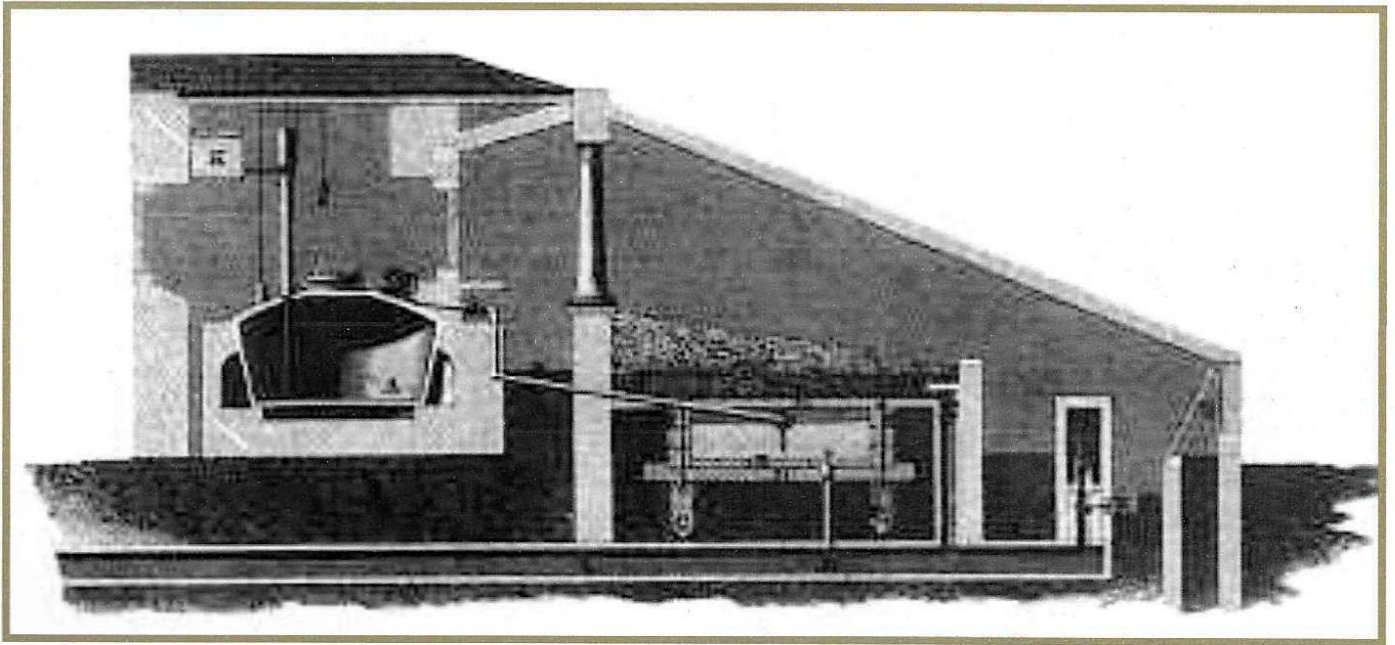


*George Stephenson's double-cylinder boiler  
(The Book of the Garden, Chas McIntosh 1853)*



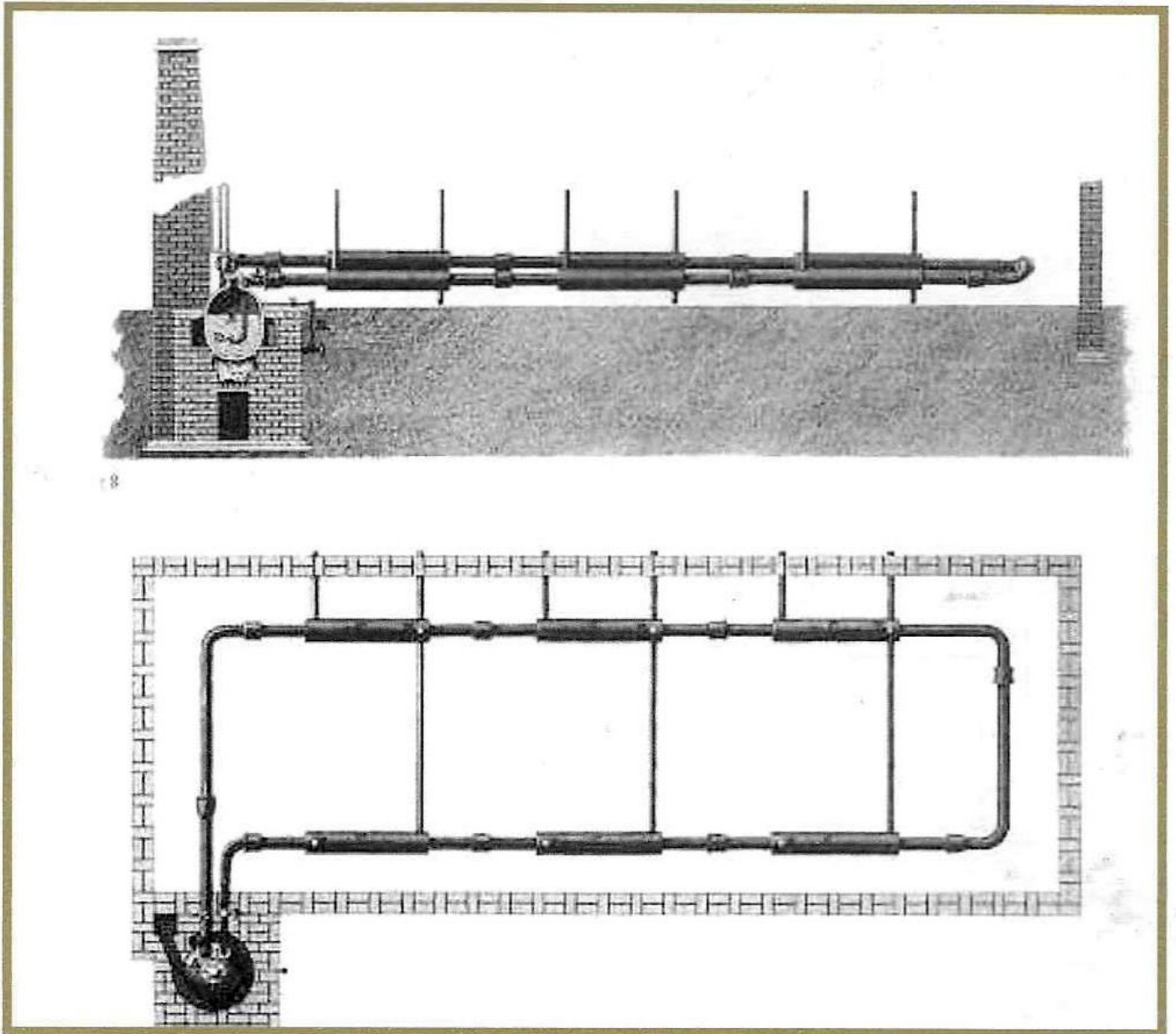


*Week's upright tubular boiler 1851*

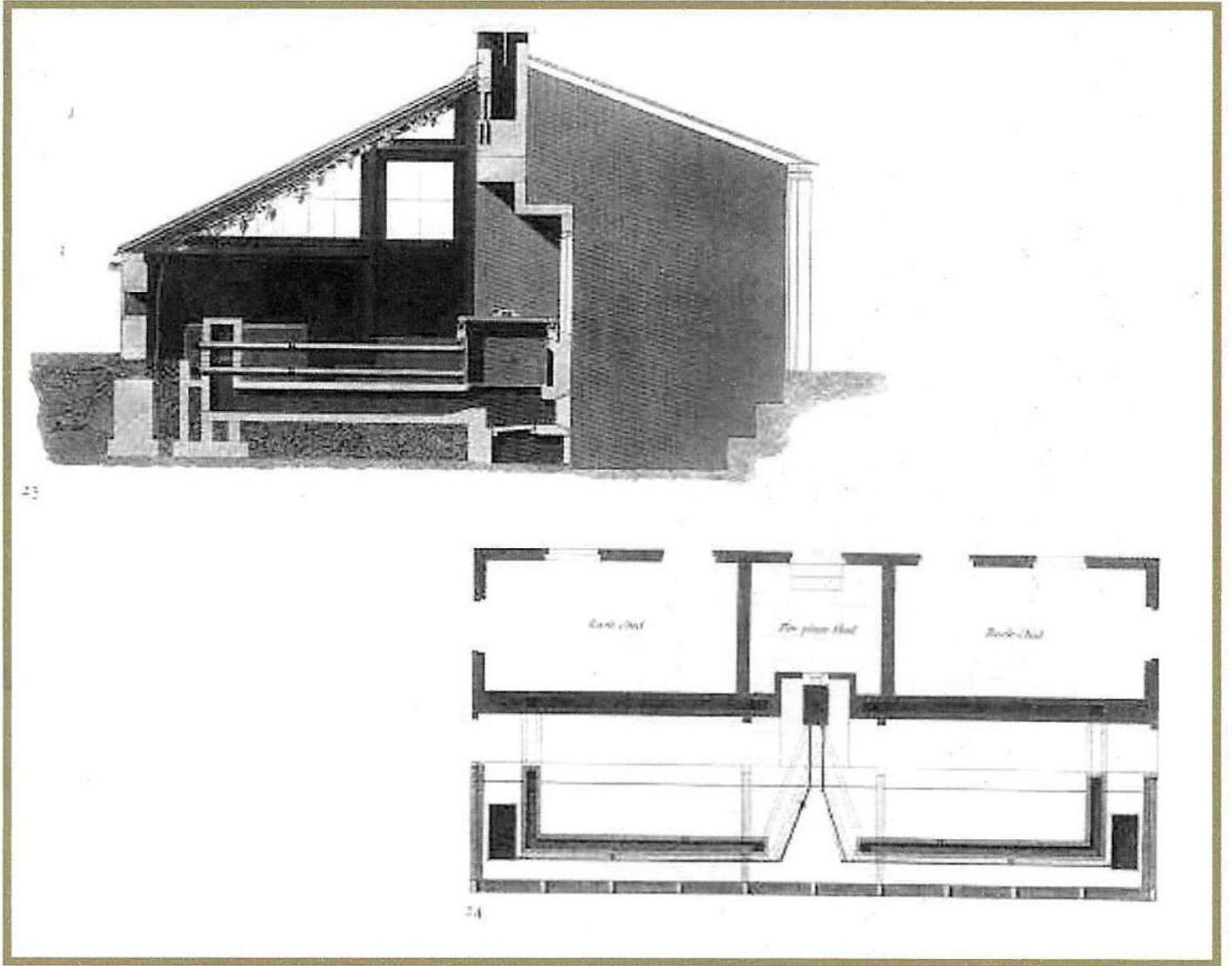


*Heating system at the Imperial Gardens, Taurida Palace, St Petersburg  
(Trans. Horticultural Soc. 1822)*



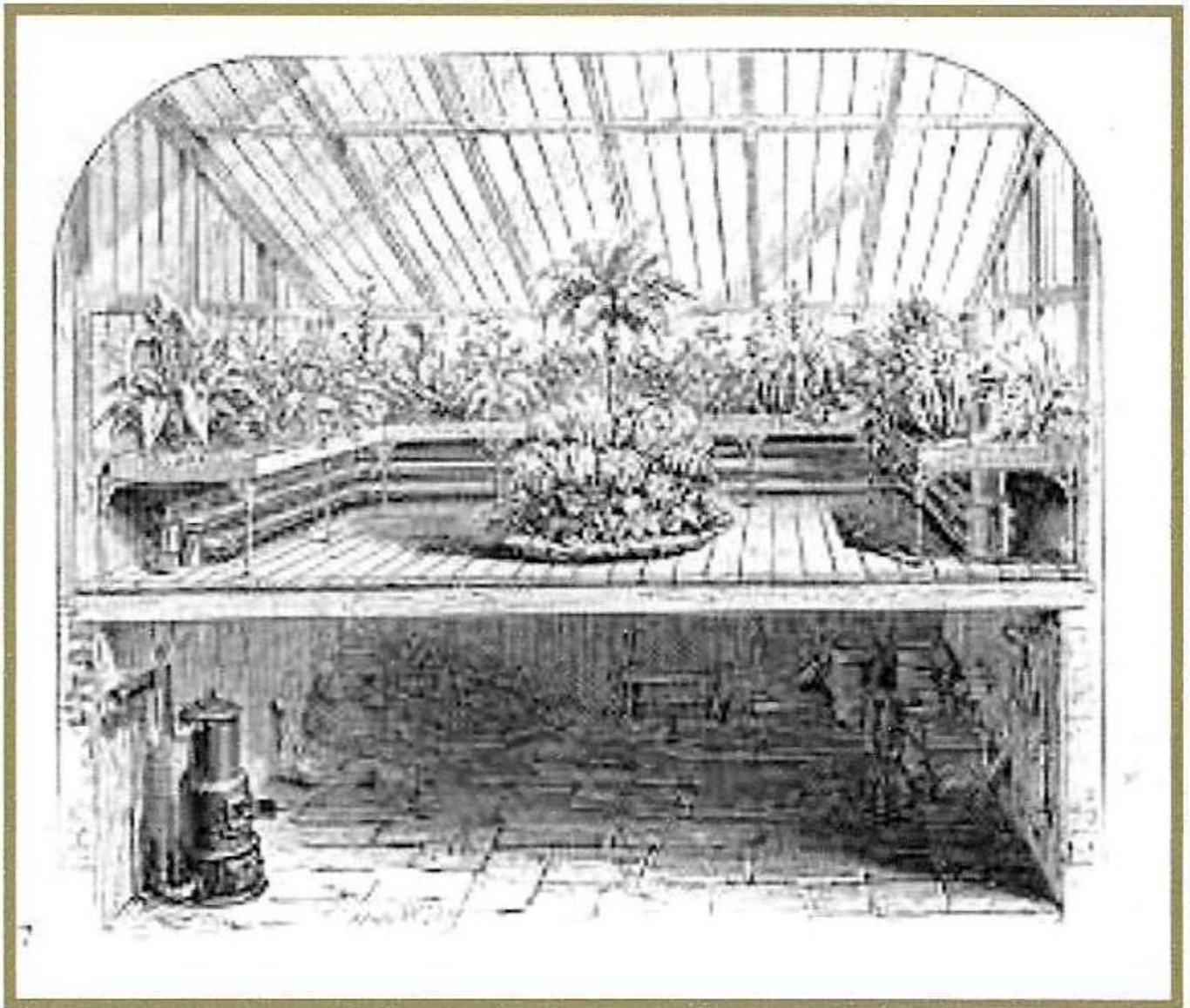


*Hague's "steam apparatus" applied to a hothouse by Joseph Hayward  
(Trans. Horticultural Soc. 1822)*

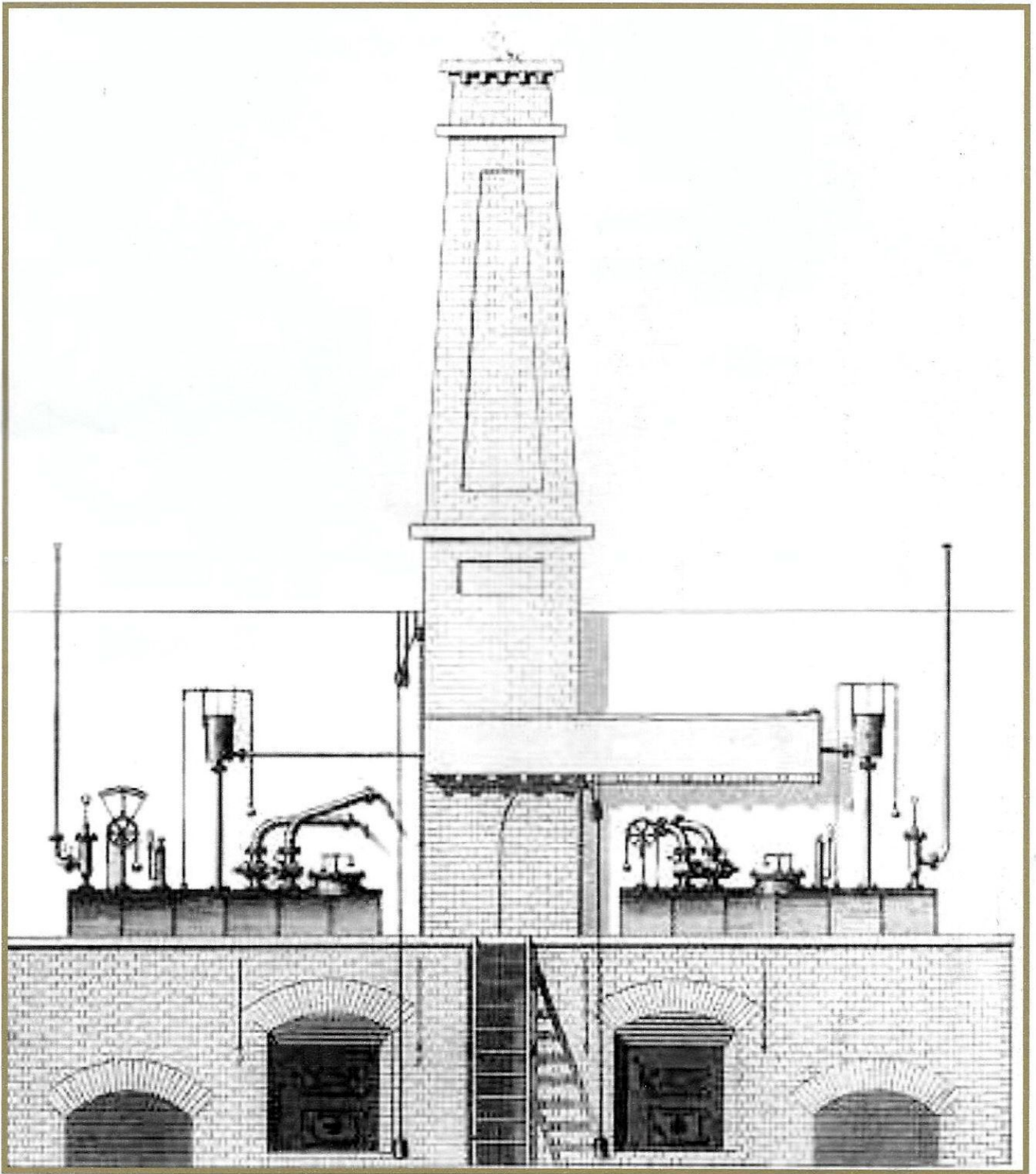


*W Atkinson's hot water heating for Anthony Bates, Aberamen, Glamorganshire 1822  
(Trans. Horticultural Soc, VII 1830)*



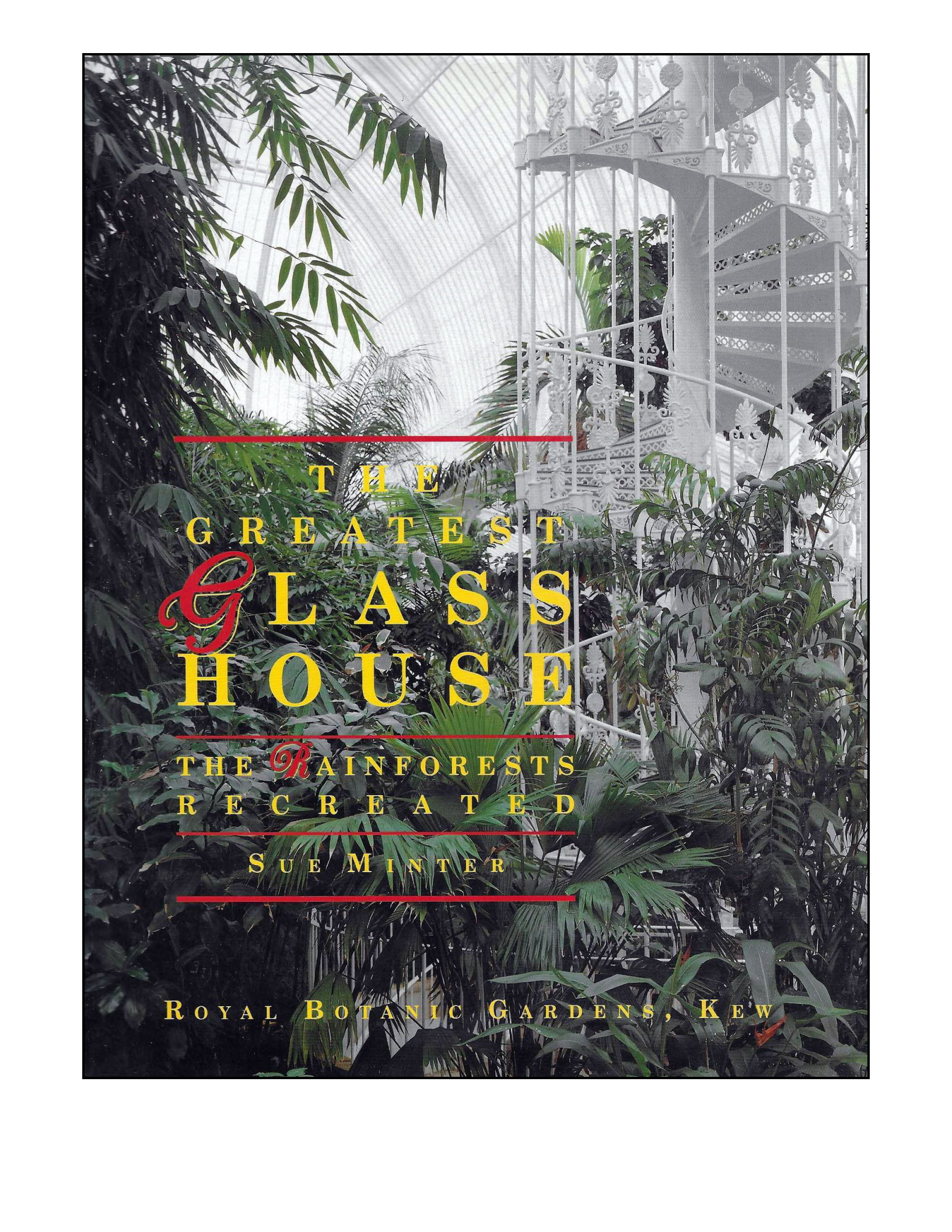


*Hitchins & Co hot water boiler, New York 1889*



*The heating "machinery" at Loddiges's nursery in Hackney 1818  
(Drawn by George Loddige)*





THE  
GREATEST  
*G*GLASS  
HOUSE

THE *R*AINFORESTS  
RECREATED

SUE MINTER

ROYAL BOTANIC GARDENS, KEW



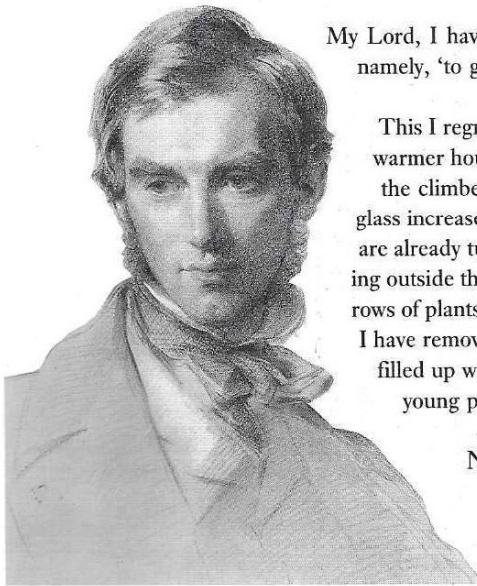
visitors to the gallery of this stove house have necessitated the erection of a second spiral staircase for their accommodation'.<sup>16</sup> The crowds of people were soon followed by crowds of plants and in his report for 1852, only four years after plants were admitted, Hooker reported that:

Some of the palms have grown so rapidly as to reach the highest span of the roof (66 feet), and two of them we have been obliged to let down into sunk compartments underground, thus to retain them a few years longer.

The building is becoming too full, and the beauty of some of the finest specimens is concealed by the space around them being occupied by other plants.<sup>17</sup>

Despite the lush growth above ground all was not well below. Smith's misgivings about Burton's choice of a 'boggy' site for the house were well founded, and the basement boiler houses flooded. A well was installed with fire-engines to pump out the water and then in the summer of 1853 the floor of the furnace rooms was raised by 20 in (51 cm). This led to further problems because it reduced the draught to the flues. In fact the first two decades of the operation of the house were dogged by heating problems. On 18 November 1865 the Curator wrote to Dr Hooker proposing that more skilled heating tradesmen should be employed. This was not an entirely surprising request because heating by hot water was a comparatively new technology. Throughout the eighteenth century heating was provided by charcoal stoves and ducted under the floors. Steam heat, which had been used at Bretton Hall, had been proposed for the Palm House but was potentially dangerous. Hot water had been used in Russia for the Tsar's glasshouse ranges but not in England until 1826. And the specification for the Palm House demanded 'a temperature of eighty degrees during the coldest weather'.<sup>18</sup> On 6 August 1867 a full report on the deficient heating in the Palm House was submitted by Messrs Eyles and Ingram.<sup>19</sup> Two days later Hooker wrote to the First Commissioner of Works giving a dire picture of the conditions in the house:

*Joseph Dalton Hooker (Dr Hooker) succeeded his father, Sir William Hooker, who had been Director of the gardens from 1841 to 1865. He presided over the house during its Victorian heyday and by the time he retired in 1885, his many achievements included advances in palm taxonomy.*



My Lord, I have given my best attention to your Lordship's verbal instructions respecting the Palm House, namely, 'to go on this winter as was done last'.

This I regret to say, is not possible, for the evil is progressive. As the plants have died, or been removed to warmer houses, or have lost their foliage, so is the heat and moisture that these intercept now dispersed; as the climbers on the rafters have been successively killed, so has the radiation of cold from the iron and glass increased . . . The plants have made no growth, and very few and small leaves this summer. The leaves are already turning yellow, and are so sparse that the pots and tubs are everywhere seen; and a person standing outside the north wing can see the museum building through it all along, that is to say, through 16 parallel rows of plants . . . During the last two winters the thermometer in the Palm House sometimes stood at 42° . . . I have removed all the most tender plants into the other houses, which we have crowded to excess, and have filled up with about 1,500 greenhouse plants instead,<sup>20</sup> for appearance's sake; till now there is not a single young palm on the shelves, and the term palm-house is a misnomer . . .

Not only was the Palm House unfit for palms, but, lamented Hooker, 'many most interesting tropical plants (as the Mango, Cocoa-nut, Chocolate, Breadfruit etc.) can no longer be cultivated in it'.<sup>21</sup> He recommended closing the house to the public from November to April.

The solution was the introduction of two flue chimneys in the wings of the house, thereby rendering the campanile superfluous. This saved a quarter of the fuel and gave an extra 10°F (roughly 5°C), although the chimneys did interrupt the smooth outline of the building.<sup>22</sup>



system have continued to this day. A circuit of pipework around the gallery was installed at Dr Hooker's suggestion in 1877 to prevent draught at high level. This was so successful that another was added to the north wing lantern. The pipework in the north wing was renewed and upgraded in 1895 and that of the south wing in 1896, with pipework being carried all the way around at high level. Further renewal of the boilers took place in 1934–5 and extra piping was added. The heavy manual labour of hauling coke through the tunnel from the Shaft Yard to the basement boilers (which had always been assigned to gardeners who had committed some misdemeanour) finally ended when the railway was electrified in 1950. In 1961 the boiler houses were moved to the Shaft Yard, leaving the Palm House basements empty. The boilers were converted to oil and the campanile came back into use as a chimney, with the tunnel serving only as a duct for the heating pipelines. The two chimney stacks in the wings were removed several years later.

The Victorian gardening staff who managed the plant collections in this building throughout its various crises did so with some ingenuity. The iron floor had never been popular with them. It had been laid in order to improve the circulation of heat, relying on the experience of Turner and Burton in flooring the Regent's Park Winter Garden (1842–6). It did have the horticultural advantage of circulating heat around the plant roots but it committed the staff to growing everything in pots and tubs. Most of the more tender tropical plants needed hotbed cultivation and for the taller palms to reach the full height of the building some planting beds were needed. The climbers also required good rooting depth to rise to their full height. Smith records that

it was with a degree of horror that I learned that the floor on which the plants were to be grown was to be of perforated cast iron squares with hotwater pipes underneath it. It consisted of 4 ft squares of cast iron, a single square is said to have cost £3 – the whole nearly £3000. On calling Sir W Hooker's attention to this to endeavour to prevent it he would not interfere, he considering that whatever Mr Burton did was right. The only concession I obtained and that with difficulty was a small space for soil at the foot of each pillar, for planting climbers in to train up the pillars, but I could get no space for soil to plant climbers to train up the rafters.<sup>23</sup>

Smith was soon proved right and in the winter of 1859–60, three years before he retired, he saw the first great Victorian Director of the gardens arrange for large beds to go into the Palm House:



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AT  
INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.  
INTERNATIONAL SCIENCE & ART EXHIBITION, EDINBURGH, 1886.  
INTERNATIONAL ELECTRICAL EXHIBITION, EDINBURGH, 1890.  
INTERNATIONAL HORTICULTURAL EXHIBITION, LONDON, 1892.  
GARDENING AND FORESTRY EXHIBITION, LONDON, 1893.  
EARL'S COURT EXHIBITION, LONDON, 1897.



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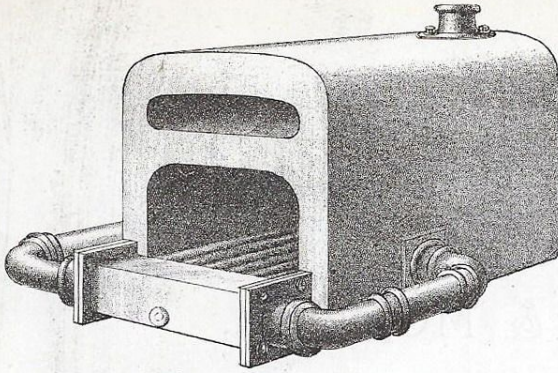
BALCARRES STREET, EDINBURGH.

Branch.  
Victoria Road,  
GLASGOW.

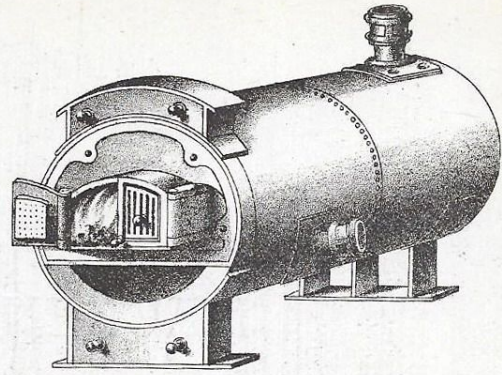
LONDON - 8 CAMDEN ROAD, N.W.



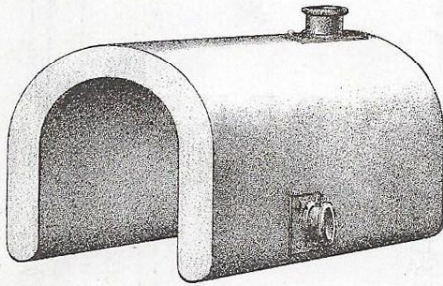




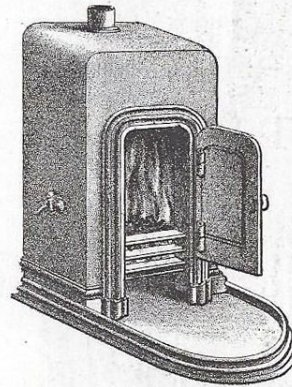
Terminal End Saddle Boiler  
with tubular water bars



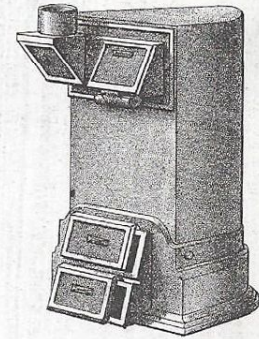
Cornish Boiler



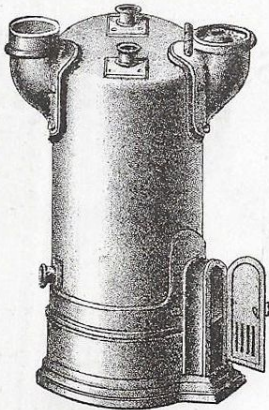
Plain Saddle Boiler



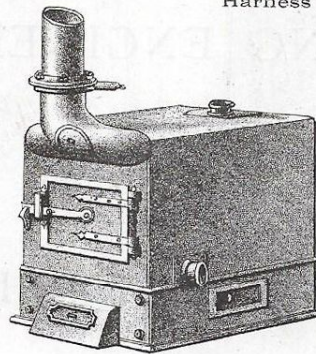
Harness Room Boiler



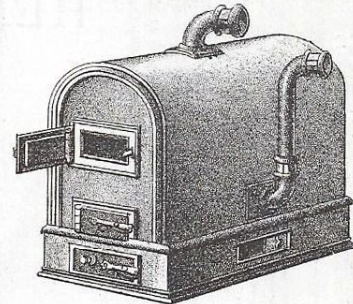
Finsbury Boiler



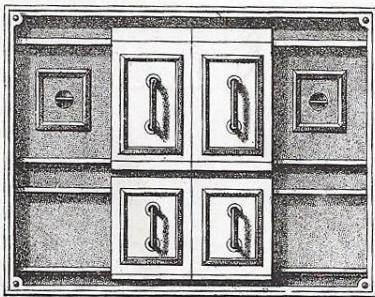
Dome-top Boiler



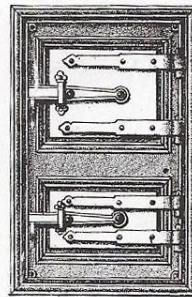
Beeston Boiler



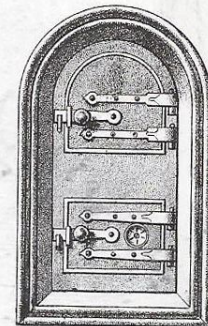
Independent Saddle Boiler



Furnace Front with sliding doors

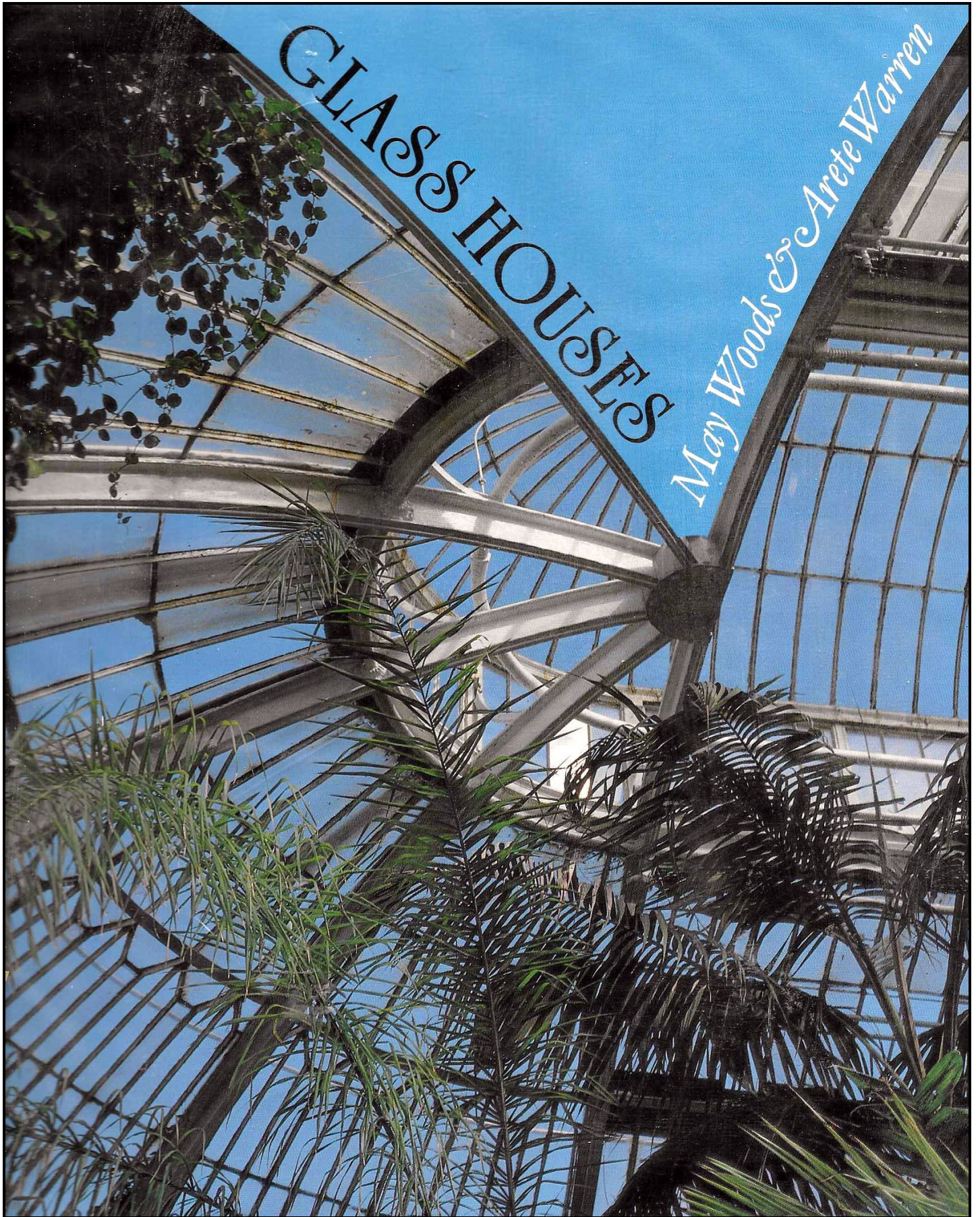


Double Door and Frame  
square top



Double Door and Frame  
arched top



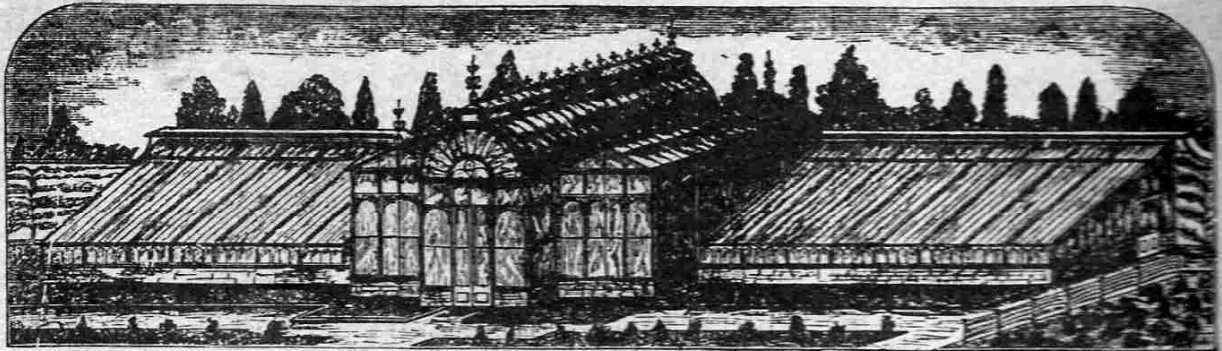


# GLASS HOUSES

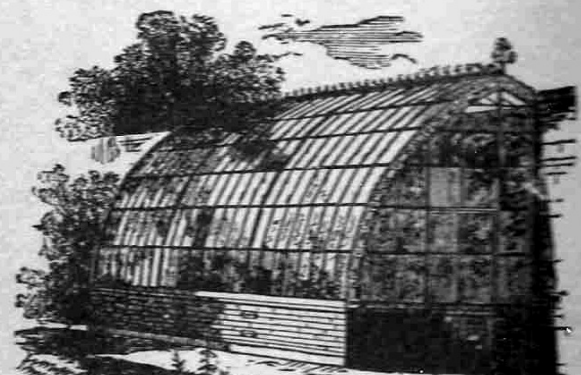
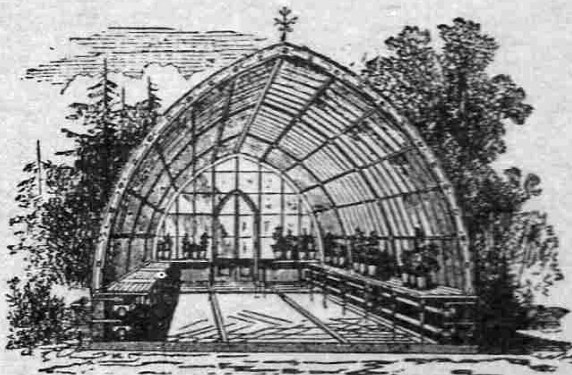
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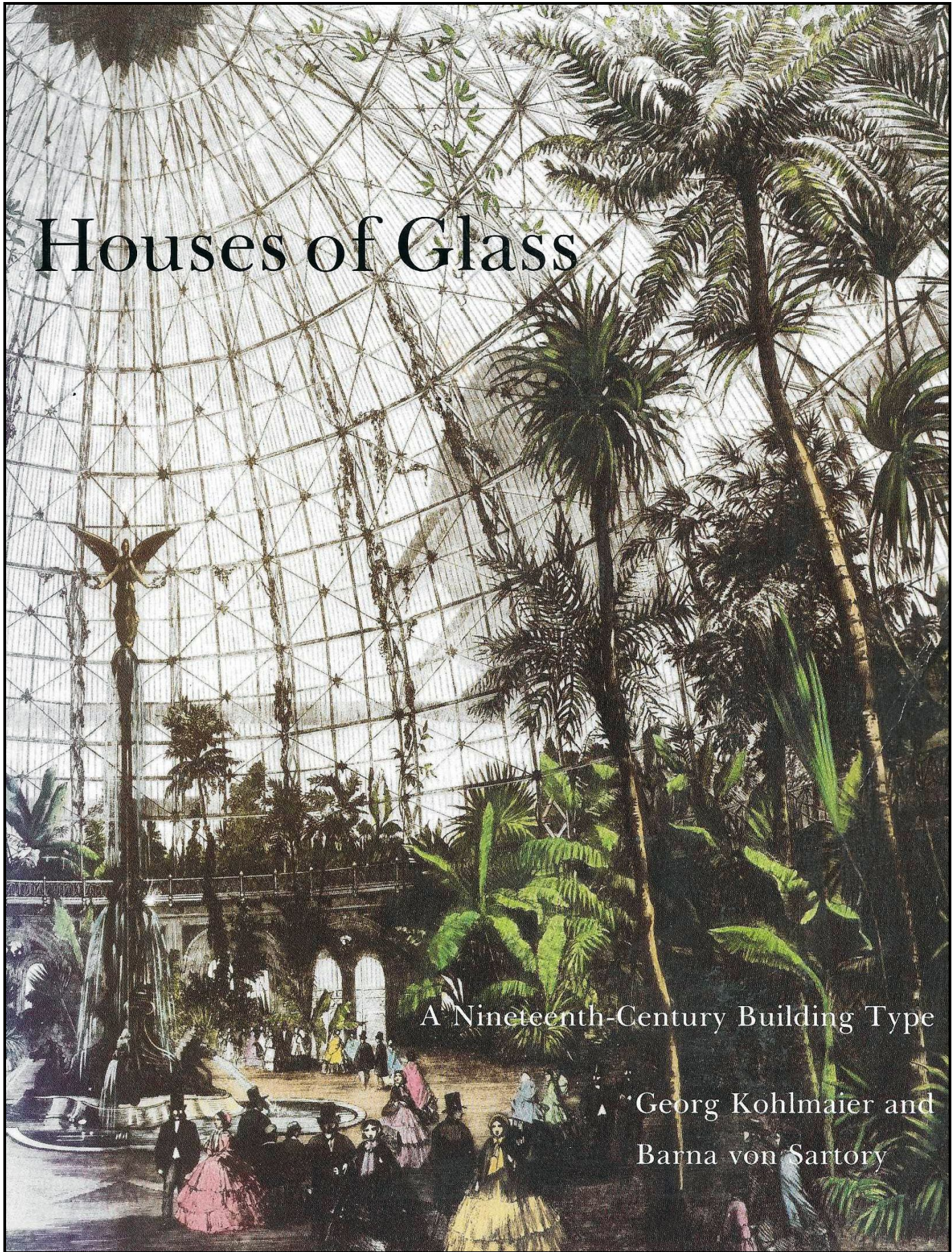
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# Houses of Glass

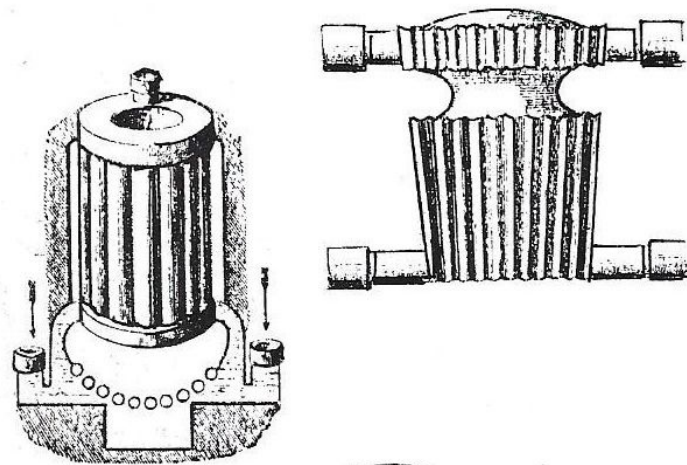
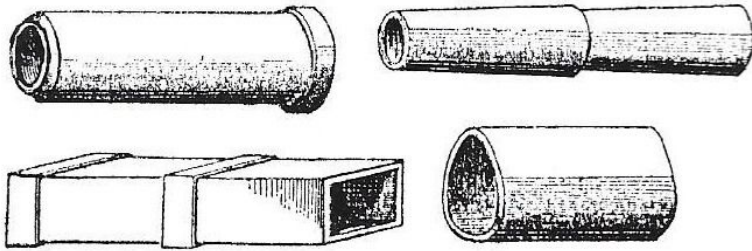
A Nineteenth-Century Building Type

▲ Georg Kohlmaier and  
Barna von Sartory

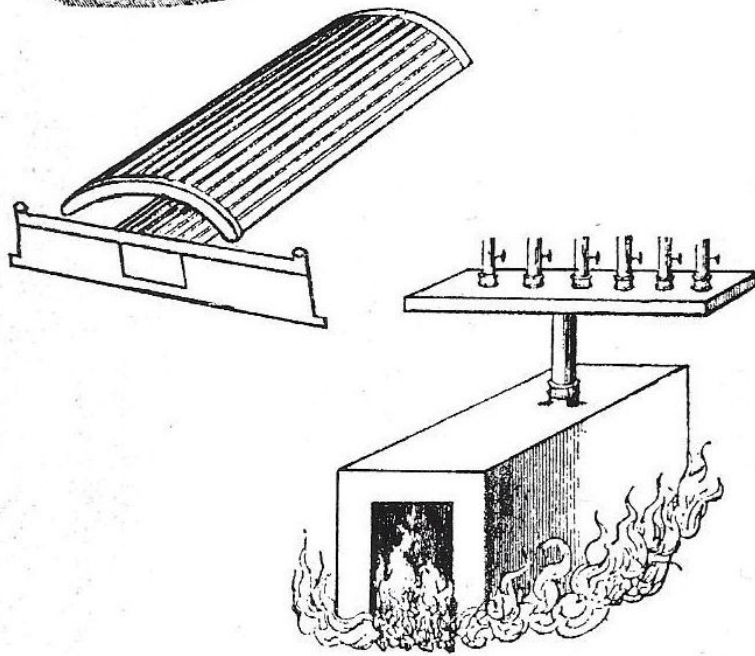




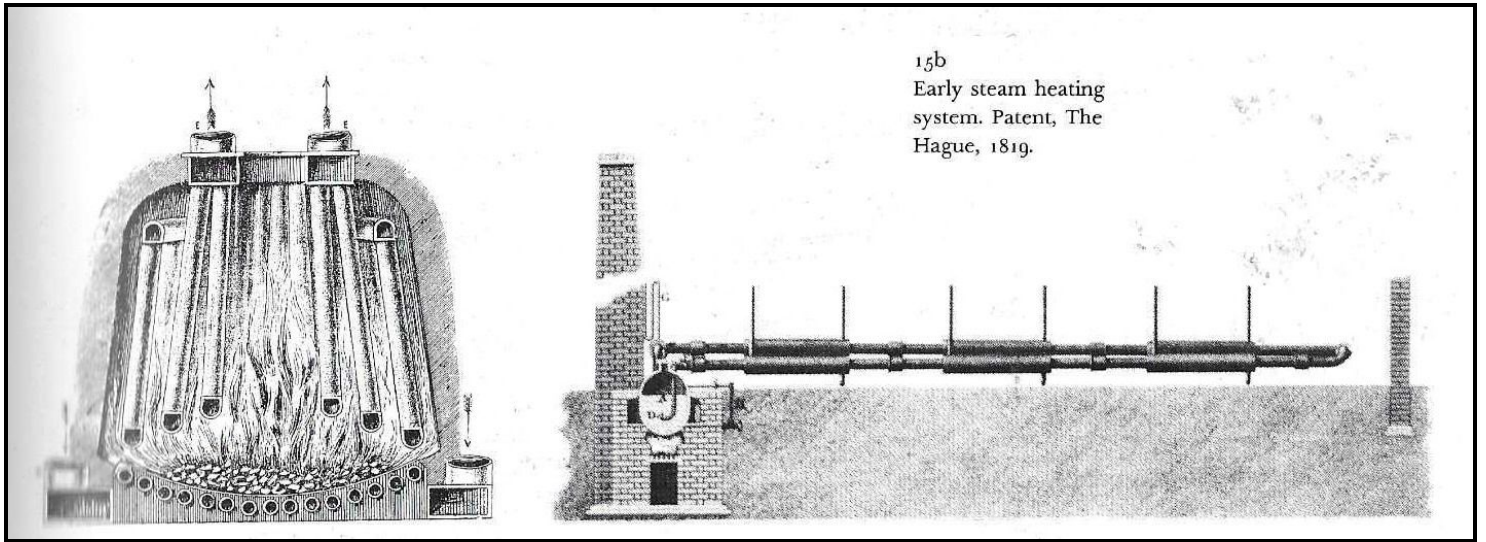
14a  
Clay pipes for smoke  
flue heating.



14b  
English boilers for  
hot-water heating.







15b  
Early steam heating  
system. Patent, The  
Hague, 1819.